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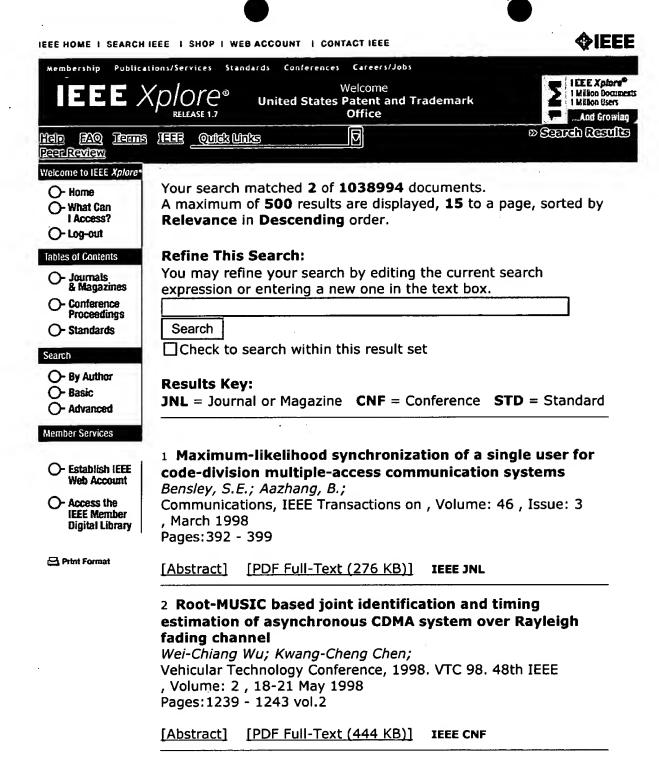
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Maximum-likelihood synchronization of a single user for code-division multiple-access communication systems

Bensley, S.E. Aazhang, B.

Cabletron Syst., Rochester, NH, USA;

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Abstract:

Code-division multiple access (CDMA) has emerged as an access protocol well-suited for voice and data transmission. One significant limitation of the conventional CDMA system is the near-far problem where strong signals interfere with the detection of a weak signal. Multiuser detectors assume knowledge of all of the modulation waveforms and channel parameters, and exploit this information to eliminate multiple-access interference (MAI) and to achieve near-far resistance. A major problem in practical application of multiuser detection is the estimation of the signal and channel parameters in a near-far limited system. We consider maximum-likelihood estimation of users delay, amplitude, and phase in a CDMA communication system. We present an approach for decomposing this multiuser estimation problem into a series of single-user problems. In this method the interfering users are treated as colored non-Gaussian noise. The **observation vectors** are preprocessed to be able to apply a Gaussian model for the MAI. The maximum-likelihood estimate (MLE) of each user's parameters based on the processed observation vectors becomes tractable. The estimator includes a whitening filter derived from the sample covariance matrix which is used to suppress the MAI, thus yielding a near-far resistant estimator

Index Terms:

Gaussian processes access protocols amplitude estimation code division

multiple access covariance matrices data communication delays filtering theory interference suppression maximum likelihood detection maximum likelihood estimation phase estimation radiofrequency interference signal sampling spread spectrum communication synchronisation telecommunication channels voice communication CDMA system Gaussian model access protocol amplitude channel parameter estimation code-division multiple-access communication systems colored nonGaussian noise data transmission delay maximum-likelihood estimation maximum-likelihood synchronization modulation waveforms multiple-access interference elimination multiuser detectors multiuser estimation near-far problem near-far resistant estimator phase processed observation vectors sample covariance matrix signal estimation single-user problems spread spectrum signals voice transmission weak signal detection whitening filter

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